## REMARKS

Claims 1-9, 11-86, 88-94, and 105 are pending in the present application. The Examiner has rejected of claims 1-9, 11-86, 88-94 and 105 under 35 U.S.C. §103(a). Applicant has amended claims 1, 5, 20, 36, 49, and 105. No new matter was introduced.

**Section 103 Rejections**

Claims 1-9, 11-29, 33-45, 47, 49-51, 53, 55-80, 84-86, 88-94, and 105 were rejected under 35 U.S.C. §103(a) as being obvious over Abreu, *et al.*, "Video-Based Multi-Agent Traffic Surveillance System", Proceedings of the IEEE 2000 Intelligent Vehicles Conference, 4-5 October 2000, pgs. 457-462, in view of U.S. Patent Application Publication No. 2007/0154067 (Laumeyer, *et al.*) and U.S. Patent No. 5,761,326 (Brady, *et al.*).

Claims 30-32, 46, 48, 52, 54, and 81-83 were rejected under 35 U.S.C. §103(a) as being obvious over Abreu.

Applicant urges that at the very least, the combination of Abreu, Laumeyer, and Brady fails to disclose or suggest Applicant's *method for detecting one or more objects belonging to the same object class* that includes *applying one or more component classifiers to detect components of objects in an image frame in the video sequence, wherein the component classifiers include classifiers for detecting object components of different sizes at multiple scales* and *wherein said method is adapted for detecting moving and stationary objects from a moving video camera,* as essentially recited in claims 1, 49, and 105.

As discussed in Applicant's responses submitted on December 6, 2007, April 18, 2008, and October 22, 2008, Abreu is directed to a video-based traffic surveillance system using stationary cameras placed along a highway. In Abreu, the area being monitored remains the same and thus Abreu deals with a static background scene of the same area. Applicant's method is *adapted for detecting moving and stationary objects from a moving video camera.* Abreu uses a change detector to detect moving objects

(e.g. vehicles) from a background scene. A change detector cannot be used with a moving camera, because the background is not static, as the image scenes captured by the camera are continuously changing. Applicant's method uses classifiers to determine if a vehicle is detected from a moving video camera.

The Examiner alleges that Abreu teaches detecting object components of different sizes, citing Abreu pg. 459, left column, lines 26-29 and 11-14, stating that "the typical size of object are used for classification . . . and since the objects being classified are car, truck, motorbike, person . . . each of the are inherently to have different sizes ." Applicant respectfully disagrees with the Examiner. Applicant first notes that Abreu discloses a single classifier (see pg. 459, left col., lines 9-10 "The classifier agent ...") trained to classify an object into one of a plurality of classifications, such as the car, truck, motorbike, person, as noted by the Examiner. In addition, the cited section of Abreu states that "classification methods are based on the matching of the observed size of a mobile object with previously gathered information of typical sizes for objects of all classes". This section only addresses matching a size of a whole object, and does not address detecting object components of different sizes, whereas Applicant's claims 1 and 63 recite using a plurality of component classifiers to detect object components of different sizes. There is no teaching or suggestion anywhere in Abreu of a plurality of classifiers for detecting object components of different sizes, and the Examiner has not shown otherwise. Thus, the Examiner's allegation that Abreu teaches detecting object components of different sizes is both incorrect and an improper application of hindsight acquired from Applicant's disclosure onto the Abreu disclosure.

Laumeyer was cited as disclosing that the method is adapted for use with a moving video camera. The Examiner, in the Office Action dated August 4, 2009, alleged that Laumeyer's vehicle mounted camera that detects road signs and pedestrians discloses a moving video camera that detects moving and stationary objects in a video stream, since pedestrians are moving objects. Laumeyer is directed to the identification of objects depicted in one or more image frames of a video stream. In particular, Laumeyer discloses building a database of road signs by processing images of roadside scenes obtained from a moving vehicle. Laumeyer's system relies on applying a set of filters to

a pre-selected set of differentiable characteristics relating to color, edges, and shape. Applicant notes that Laumeyer does not teach or suggest the use of classifiers trained by a training set to recognize object components.

In the current Final Office Action, the Examiner simply alleges that Laumeyer discloses detecting a stationary object from a moving video camera and that Abreu discloses detecting a moving object, and concludes that it is obvious to combine Abreu with Laumeyer. Applicant notes that Abreu does not teach or suggest detecting objects, stationary or moving, from a moving camera. Furthermore, in the response submitted on October 8, 2009, Applicant pointed out why Laumeyer does not disclose detecting a moving pedestrian, or any other moving object, from a moving video camera. The Examiner has not responded to this argument in the current Final Office Action. Thus, Applicant urges that combining Abreu with Laumeyer would yield a system that could detect moving objects from a stationary camera, and stationary signs from a moving camera, but not a system capable of *detecting moving . . . objects from a moving video camera*, as essentially recited in independent claims 1, 49, and 105.

The Examiner cited Brady, col. 11, lines 38-50, as disclosing classifiers for detecting object components at multiple scales. Brady is directed to a machine vision system that acquires images from a plurality of stationary roadway sites and uses fuzzy set theory to process the images. Brady's method for classifying vehicles involves computing a vector for each pixel from horizontal and vertical edge element intensity data, fuzzifying the angle and location data in a region of interest, as weighted by the magnitude of the intensities, and creating a single vector characterizing the entire region of interest. A neural network then analyzes the single vector and classifies the vehicle. After classification, a vehicle can be tracked to predict potential future track points. The section cited by the Examiner discloses a graphical representation of the placement of potential future track regions in an image, and further discloses proportionately shrinking the moving object along the camera's line of sight. The Examiner alleges that because a tracked object shrinks as it moves away from the camera, the object is being scaled down, and this shrinking effect teaches detecting objects at multiple scales. Applicant respectfully disagrees with the Examiner. Proportionately shrinking a moving object

does not teach or suggest using *component classifiers . . . for detecting object components of different sizes at multiple scales*, as the object being shrunk has already been detected by application of fuzzy set theory. Furthermore, by applying fuzzy set theory to an entire region of interest, Brady's does not teach or suggest applying a plurality of component classifiers to detect object components in the image.

Regarding claims 49 and 37, the Examiner alleged that Abreu teaches accumulating confidence scores across multiple frames using a recursive filter, stating that "the algorithm used to determine the next trajectory adjusts itself whenever new information is received, thus making it repeat and re-occur", citing page 459, left-hand column, lines 49-50. Applicant respectfully disagrees. In the response submitted on October 8, 2009, Applicant has point out that since Abreu is directed to a video-based traffic surveillance system using stationary cameras placed along a highway, a stationary camera cannot track a detected object as a moving object will eventually pass out of the view of a stationary camera. The tracking performed by Abreu consists of matching a description of an object observed with one camera with an object description observed with a second camera (pg. 459, right column, lines 14-31). Abreu does not, and cannot, disclose a single moving cameras tracking a moving object, as recited in Applicant's claims 1, 49, and 105. Furthermore, in the section of Abreu cited by the Examiner as disclosing this limitation, pg. 459, left column, line 49-50, the Examiner appears to confuse the concept of "trajectory" with "confidence scores". A confidence score is used to determine if an object has been detected. It is not a trajectory. Only after an object is detected does Applicant's method track the object over subsequent image frames, as recited in claims 40 and 90, and their respective dependent claims. The Examiner did not respond to these arguments in the current Final Office Action. Thus, Applicant concludes that the limitation *the accumulated confidence scores are inferred from confidence scores across multiple frames using a recursive filter* recites patentable subject matter.

Regarding claims 105 and 20, the Examiner cites Laumeyer, paragraph [0056] as disclosing that *the one or more component classifiers include overlapping component classifiers*. The Examiner argues that Laumeyer's use of shape and color to segment road

signs discloses "overlapping component classifiers" because these are used to classify a single object. Applicant notes that the "overlapping component classifiers" recited in claims 20 and 105 are used to detect components of an object, and shape and color, while being characteristics of a whole object, do constitute components of an object. Furthermore, as noted in Applicant's response filed on November 25, 2008, Laumeyer nowhere discloses the use of classifiers to identify signs in video streams, but rather uses pre-defined image features and image filters to segment objects. The cited section of Laumeyer discloses how morphology can be used to determine the basic shape of an object that has been initialized with a pixel from a pre-selected color set. Paragraph [0016] discloses other pre-selected features used to perform classification, such as frequency and spatial domain transformation, edge domain transformation, color transformation, and aspect ratio, and video image frames are transformed by a set of filters for these pre-selected features logically combined with algorithmically or with OR gates. However, a classifier is well understood in the art as a function that has been trained to recognize objects in newly presented images, by using a training set of positive examples of the object to be recognized. A set of filters that select for pre-defined characteristics would not be recognized as a classifier by one of skill in the art. There is no teaching or suggestion in paragraph [0056] or anywhere else in Laumeyer of training a classifier, much less of *one or more classifiers include overlapping component classifiers*, as recited in claim 105. The Examiner's allegation that color and shape are considered overlapping classifiers because these describe a same object constitutes another improper application of hindsight acquired from Applicant's disclosure onto Laumeyer's disclosure. Furthermore, since Laumeyer does not disclose classifiers, Laumeyer cannot disclose overlapping component classifiers, since one derives from the other. What the Examiner characterizes as "overlapping component classifiers" are in fact just two different pre-defined features of the whole object. The Examiner's response in the current Final Office Action is a restatement of previously presented rejections, not a response to Applicant's arguments.

The Examiner also cited Abreu, pg. 461, Fig. 4 and pg. 462, left column, lines 3-8 as disclosing that *the one or more classifiers include overlapping component classifiers.*

This section of Abreu discloses how one can infer a 3D shape from a 2D extracted object, assuming plane motion and rigid objects. From the resulting cloud of 3D points a 3D size (a bounding box), position and speed are inferred, and Fig. 4 depicts typical results. The Examiner seems to confuse Fig. 4 with the real image appearance, i.e. real pixel values in an image area which is being processed by the methods of claims 1 and 105. Abreu does not detect any object components, and the bounding box is a sketch made to enclose an image area where a moving object has been detected by a change detector. The Examiner also alleges that "the overlapping component may be the different information extracted from the 3D information, since all information is based on a single object." Applicant urges that the Examiner appears to be making up her own definition of overlapping, since different information extracted from a same object need not be from overlapping component classifiers. Furthermore, the method outlined in Abreu (estimating a motion field within segmented object masks, determining the structure of the object without scale, and matching the corresponding shape with a 2D mask to yield scale information) nowhere teaches or suggests that *one or more component classifiers include overlapping component classifiers*. Again, by inferring *overlapping component classifiers* from Abreu, the Examiner is again engaging in an improper application of hindsight acquired from Applicant's disclosure onto the Abreu disclosure. The Examiner has not responded to these arguments in the current Final Office Action.

Regarding claims 105 and 11, the Examiner alleges that Abreu teaches the use of classifiers, citing pg. 459, left column, lines 37-38. Applicant respectfully disagrees. The cited section of Abreu states that the "adaptation of the class templates is based on well known algorithms for competitive learning", citing S. Haykin, Neural Networks: A Comprehensive Foundation, Prentice Hall, 1999. Thus, Abreu discloses the use of neural networks, and does not disclose the use of classifiers trained by boosting. The Examiner has not responded to these arguments in the current Final Office Action.

Thus, Applicant urges that neither Abreu, Laumeyer, nor Brady, either singly or in combination, teach or suggest all limitations of independent claims 1, 49, and 105, and thus Applicant urges that a *prima facie* case of obviousness against claims 1, 49, and 105 over Abreu, Laumeyer and Brady cannot be maintained. Reconsideration and withdrawal

of these rejections are respectfully requested.

Claims 2-9, 11-29, 33-45, 47, 50-51, 53, 55-80, 84-86 and 88-94 all depend from either claim 1 or claim 49, and are patentable for at least the same reasons as claims 1 and 49. Reconsideration and withdrawal of these rejections are respectfully requested.

Similarly, claims 30-32, 46, 48, 52, 54, and 81-83 all depend from either claim 1 or claim 49, and are patentable for at least the same reasons as claims 1 and 49. Reconsideration and withdrawal of these rejections are respectfully requested.

Further regarding claim 2, the Examiner cited Abreu, page 459, left column, lines 22-25, as disclosing identifying the detected components to be an object of a particular object class. Applicant respectfully disagrees. Abreu's classifiers can distinguish cars, trucks, pedestrians, motorbikes, etc., and the classification has one of the following values: car, truck, motorbike, etc (see page 459, left column, lines 9-14). Applicant's object class classifiers separate objects of a particular class from background scenes, and the classification has one the following values: object of object class, not-object of object class.

Regarding claims 5 and 9, the Examiner cited Examiner cited Abreu, page 459, left column, lines 26-29 as disclosing *applying whole-appearance classifiers an image patch that contains the detected components and which is aligned according to the position of the detected components . . . wherein the whole appearance classifiers detect entire or partial object appearance, the entire or partial object appearance being aligned according to positioning of at least two components.* Again, Applicant respectfully disagrees. The classification method disclosed in Abreu uses size information of a typical object to decide what type of an object that an moving target is, whereas the whole appearance classifier recited in claims 5 and 9 uses appearance information to decide whether or not an image patch contains an object of a particular object class.

Claims 12-17 recite examples of the discriminant features recited in claim 11. The Examiner cited Abreu, page 461, Fig. 4 as disclosing each of the discriminant features recited in claims 12-17, alleging that Abreu's system has identified an object and

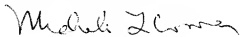
formed a box, and that the box has the recited feature. Applicant respectfully disagrees with the Examiner. Applicant notes that the bounding box in Fig. 4 is a sketch made to visualize the detected object, where the positions of the box corners, edges, etc., are not the same as the actual image locations of vehicle corners, edges, etc. The Examiner seems to confuse the bounding box with the object itself, which is being processed by the methods recited in claims 1, 49, and 105. The discriminant features are image features calculated from real pixel values, not artifacts of a box added to enclose a detected object. Applicant's recited methods detect actual vehicle corners, edges, stripes, etc., by using dedicated component classifiers, which output precise locations in a two-dimensional image.

Claims 21-27 recite examples of components detected by the overlapping component classifiers. The Examiner cited Abreu, page 461, Fig. 4 as disclosing each of the components recited in claims 21-27, alleging that Abreu's system has identified an object and formed a box about the object which is a vehicle driving on a road. Again, Applicant respectfully disagrees with the Examiner. Applicant notes that Abreu does not teach or suggest component classifiers at all, and showing a vehicle enclosed by a bounding box implies nothing about how the vehicle was detected, much less that it was detected by application of a plurality of overlapping component classifiers.

## CONCLUSION

Applicant urges that claims 1-9, 11-86, 88-94, and 105, as amended, are in condition for allowance for at least the reasons stated. Early and favorable action on this case is respectfully requested.

Respectfully submitted,



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